Attorney Docket No. 02316.1834US01

PATCH PANEL WITH MODULES

Technical Field

The disclosure generally relates to devices and assemblies for patch panel systems. More particularly, this disclosure relates to a patch panel with access modules.

Background of the Invention

Patch panels are used to provide an interconnection between network elements. Patch panels typically include interconnecting circuitry positioned on or within a housing or other panel structure for connecting two telecommunications cables. Conventional interconnecting circuitry includes jacks and other cable interface structures which are electrically connected in order to electrically connect the telecommunications cables.

In general, improvement has been sought with respect to such systems and arrangements to provide additional functionality and usability.

Summary of the Invention

One aspect of the present disclosure relates to a patch panel including a back plane having a front major surface and a back major surface facing in an opposite direction. A plurality of pairs of termination locations are mounted to the front major surface of the back plane. Each termination location includes a patch cord access device including electrical contacts connected to the back plane for electrically connecting to conductors in the patch cord. A plurality of interconnect locations mounted to the front major surface of the back plane provide access to the termination locations.

Each interconnect location preferably defines a card edge socket with normally connected contact pairs connected to the back plane. Circuitry on the back plane connects each pair of termination locations to one of the interconnect locations.

Under normal conditions, the patch panel electrically connects two telecommunications cables connected at the termination locations. The interconnect location allows selective access to the termination locations.

In one preferred embodiment, an interconnect module defines an edge contact sized for receipt in one of the card edge sockets of the interconnect locations. The interconnect module adds functionality to the circuit, such as test access, power over Ethernet, or circuit protection features.

Brief Description of the Drawings

Figure 1 is a front view of a patch panel in accordance with one embodiment of the present invention.

Figure 2 is a top view of the patch panel of Figure 1.

Figure 3A is a schematic showing one patching circuit including two RJ45 jacks.

Figure 3B is a schematic showing a second patching circuit including one RJ45 jack and one insulation displacement contact.

Figure 3C is a schematic showing a third patching circuit including two insulation displacement contacts.

Figure 4 shows the circuitry on a portion of the back plane.

Figure 5 is a side view of an interconnect module.

Figure 6 is an end view of the interconnect location.

Figure 7 is a side view of an RJ45 jack.

Figure 8 is a side view of an insulation displacement contact.

Figure 9 is a front view of a second embodiment of a patch panel.

Figure 10 is a back view of the patch panel of Figure 9.

Figure 11 is a side view of the patch panel of Figure 9.

Figure 12 is a top view of the patch panel of Figure 9.

Figure 13 is an exploded perspective view of the patch panel of Figure 9.

Figure 14 is an enlarged view of a portion of the patch panel of Figure 9.

Figure 15 is a front view of a third embodiment of a patch panel.

Figure 16 is a back view of the patch panel of Figure 15.

Figure 17 is a side view of the patch panel of Figure 15.

Figure 18 is a top view of the patch panel of Figure 15.

Figure 19 is an exploded perspective view of the patch panel of Figure 15.

Figure 20 is an enlarged view of a portion of the patch panel of Figure 15.

Figure 21 is a front view of a fourth embodiment of a patch panel.

Figure 22 is a back view of the patch panel of Figure 21.

Figure 23 is a side view of the patch panel of Figure 21.

Figure 24 is a top view of the patch panel of Figure 21.

Figure 25 is an exploded perspective view of the patch panel of Figure 21.

Figure 26 is an enlarged view of a portion of the patch panel of Figure 21.

Figure 27 is a perspective view of an interconnect module in accordance with one embodiment of the present invention.

Figure 28 is an exploded perspective view of the interconnect module of Figure 27.

Figure 29 is a plan view of one of the housings of the interconnect module of Figure 27.

Figure 30 is a first side view of the housing of Figure 29.

Figure 31 is a second side view of the housing of Figure 29.

Figure 32 is a cross-sectional side view of the housing of Figure 29 similar to the view of Figure 30.

Detailed Description of the Preferred Embodiments

Referring now to Figures 1 and 2, one preferred embodiment of a patch panel 10 is shown. Patch panel 10 includes a chassis 12 which can be rack mounted or mounted to other frames or cabinets. Brackets 14 are used to mount chassis 12 to a

rack. Patch panel 10 has a front 18, and an opposite back 20. Brackets 14 are located on sides 16. As will be described in further detail below, the preferred embodiment is front accessible for the cables connected through patch panel 10.

Patch panel 10 includes a plurality of patching circuits 22a. Alternatively, patching circuits 22a can be referred to as ports 22a. In the illustrated embodiment, 24 patching circuits 22a are provided. Other numbers of circuits can be provided as desired.

Patch panel 10 includes a back plane 24 having a front major surface 26 and an opposite facing back major surface 28. As will be described below, circuitry 30 including tracings 32 (Figure 4) connect the various elements of patching circuit 22a.

Patch panel 10 can be powerless and without external control features. In some preferred embodiments, power modules 34 can be provided to introduce power into patch panel 10, such as for power over Ethernet functions. The power modules 34 (two are shown in Figure 2) can be mounted to back major surface 28 of back plane 24. A CPU module 36 can also be mounted to back plane 24 at back major surface 28 to provide for system control, if desired. The CPU module can be installed for local and remote management for control and status monitoring.

Patch panel 10 includes pairs of connectors 40, also referred to as termination locations 40, for connecting to patch cords. Each connector 40 includes a patch cord access including electrical contacts for electrically connecting to back plane 24. Further, the patch cord access electrically connects to conductors in the patch cord. As will be described in greater detail, connectors 40 can include RJ45 connectors 42 or insulation displacement contacts (IDC's) 46 (see Figures 3B, 3C and 4). Other data connectors can be used, such as DB-9 connectors.

Circuitry 30 on back plane 24 connects to the pairs of connectors 40. Circuitry 30 also connects to an interconnect location 48 associated with each patching circuit 22a and the other patching circuits described herein. Interconnect location 48 defines a selective access location for accessing the electrical connections between the pairs of connectors 40. Interconnect location 48 in the preferred embodiment includes a plurality of normally connected or closed contact pairs connected to the back plane.

The normally connected contact pairs can be interrupted by the introduction of an interconnect module 56. Preferably, the contact pairs are make before break contact pairs.

Other contact pairs in interconnect location 48 can be normally open. Such contacts can be dedicated power contacts or control signal contacts.

In one preferred embodiment, interconnect location 48 defines a card edge socket (Figure 6). Each interconnect module 56 includes a card edge for mating with the card edge socket (Figure 5).

Referring now to Figure 3A, patching circuit 22a is shown schematically. Two connectors 40 in the form of RJ45 connectors or jacks 42 are electrically connected through back plane 24 and interconnect location 48. RJ45 jacks 42 mate with patch cords 52. Patch cord 52 includes plug ends 53. Interconnect module 56 mates with interconnect location 48. Module 56 can be provided with functionality, as desired. For example, interconnect module 56 can provide test access, in an intrusive manner, or in a non-intrusive manner, as a monitor. Module 56 could alternatively be provided with circuitry for providing power over Ethernet (PoE) or GR-1089 or other circuit protection. Circuit protection features can include over voltage protection across each pair of connectors 40.

Referring now to Figure 3B, instead of two RJ45 jacks as in Figure 3A, patching circuit 22b includes one RJ45 jack 42, and one insulation displacement contact 46 for connecting patch cords 52, 54, respectively. Patch cord 54 includes individual wires 55 which are mated to insulation displacement contact 46.

Referring now to Figure 3C, patching circuit 22c is provided with two insulation displacement contacts 46 for connecting two patch cords 54.

Referring now Figure 4, back plane 24 is shown with circuitry 30 linking to the pairs of termination locations 40 in the form of RJ45 jacks 42 and insulation displacement contacts 46. Circuitry 30 also links to the contact pairs of interconnect locations 48. As shown in Figure 4, two RJ to RJ patching circuits 22a, two RJ to IDC patching circuits 22b, and three IDC to IDC patching circuits 22c are shown.

Referring now to Figure 6, interconnect location 48 includes a housing 80 including a socket 82 for receiving a card edge of interconnect module 56. Contact pairs 84 include normally closed ends 86. Tips 88 electrically connect to back plane 24. Interconnect location 48 includes 14 contact pairs 84.

Referring now to Figure 7, RJ45 jack 42 is shown including a housing 60 defining a socket 62. A spring 64 is positioned such that a spring end 66 is disposed within socket 62 for engaging plug 53 of patch cord 52. Tip 68 electrically connects to back plane 24. Typically, RJ45 jack 42 includes eight springs 64.

Referring now to Figure 8, insulation displacement contact 46 is shown including a housing 70 which defines a socket 72 and holds a contact 74. Contact 74 includes a wire contacting end 76 for contacting a wire 55 of patch cord 54. An opposite end defines a tip 78 for electrically connecting to back plane 24. In the illustrated embodiment, each insulation displacement contact 46 includes four contacts 74.

Referring back to Figure 5, module 56 includes a card edge or edge contact 90 for receipt in socket 82 of interconnect location 48. A front 92 includes the desired features for module 56, including test access ports. The ports can allow intrusive testing or access, or non-intrusive testing or access, such as a monitor. Module 56 includes circuit functions 94 including appropriate tracings and other circuit elements as needed. In the case of power over Ethernet, module 56 is preferably flippable, to send power out to either connector 40. In this manner, DC power can be simplexed with Ethernet data for transmission at one of connectors 40.

Patch panel 10 can be implemented as a patch through panel with access. The modules 56 can be added in the signal paths without disrupting signal service. If power and control functions are needed later, the modules can be added to back major surface 28 of back plane 24, with appropriately configured circuitry on back plane 24 to allow the power and control connections.

Referring now to Figures 9-14, a further embodiment of a patch panel 100 is shown. Back plane 124 includes RJ45 jacks 142 and interconnect locations 148 similar to RJ45 jacks 42 and interconnect locations 48 noted above. Interconnect

locations 148 receive interconnect modules 156. A panel construction 160 holds back plane 124. Fasteners 166 are received by flanges 162 of housing construction 160. A PEM fastener 164 with internal threads mounted to flange 162 can be used to interface with fasteners 166.

Referring now to Figures 15-20, a still further embodiment of a patch panel 200 is shown. Back plane 224 includes insulation displacement contacts 246 and interconnect locations 248 similar to insulation displacement contacts 46 and interconnect locations 48 noted above. Interconnect locations 248 receive interconnect modules 256. A panel construction 260, 262 holds back plane 224. Fasteners 264 mount panel constructions 260, 262 together. A PEM standoff 266 with internal threads mounted to panel construction 260 can be used between back plane 224 and panel construction 260.

Referring now to Figures 21-26, a further embodiment of a patch panel 300 is shown. Back plane 324 includes insulation displacement contacts 346 and interconnect locations 348. Interconnect locations 348 receive interconnect modules 356. A similar panel construction 360, 362 holds back plane 324 in a manner as noted above for patch panel 200. Instead of insulation displacement contacts 246, an alternative embodiment of an insulation displacement contact 346 is used, including electrical contacts 366. Interconnect locations 348 are similar to interconnect locations 48, 148, 248 noted above.

Panel constructions 260, 262 and 360, 362 are similarly arranged. Panel constructions 262, 362 are positioned adjacent to a rear side of back planes 224, 324, respectively. Rear panel constructions 262, 362 support insulation displacement contacts 246, 346 during the punch down operations to connect them to the individual wires of the patch cords.

Referring now to Figures 27-32, interconnect module 156 is shown in greater detail. Similar constructions for interconnect modules 256, 356 are provided. Interconnect module 156 includes two identical housings 400 mated together around a circuit board 403. A card edge 404 is defined by a protruding portion of circuit board 403 which protrudes outside of housings 400. Housings 400 are identical in shape, so

as to reduce manufacturing costs. Tabs 406 and slots 407 mate together to snap housings 400 together. Standoffs 408, 410 position circuit board 403 between housings 400. Standoff 408 is in the form of a peg or post, and standoff 410 is in the form of a recess for receiving the post. Posts 408 are received in holes 412 through circuit board 403. A front 402 of module 156 can define the access ports if provided as part of the functionality of the modules.

The above specification, examples and data provide a complete description of the manufacture and use of the composition of the invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.